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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

SUBJECT: Indoor Air Analysis of Residual Contamination at the Maryland Sand, Gravel & Stone Superfund Site **DATE:** 3/19/02

FROM: *Patricia I. Flores-Brown*
Patricia I. Flores-Brown, Air/Superfund Coordinator
Air Quality Planning & Information Services Branch (3AP21)

TO: Debra Rossi, Remedial Project Manager
General Remedial Section (3HS23)

In response to your recent request, I performed an indoor air analysis for the Maryland Sand, Gravel and Stone Superfund site. After remediation of the site contaminants, residual soil and groundwater contamination may be the source of contaminant vapors into indoor spaces. To assess the potential risks to future residents with a home directly over the contaminated groundwater plume or on residual soil contamination, the screening versions of the subsurface vapor intrusion model, Johnson & Ettinger, were used to estimate the concentrations of contaminants in the indoor air. Since the Johnson & Ettinger model contains toxicological parameters, the cancer and non-cancer risks associated with the indoor air concentrations were also calculated. However, I recommend that these calculated indoor air concentrations and risk values be made available to the EPA site toxicologist, Dawn Ioven, so that the associated risk can be verified.

A few compounds found in the groundwater and soil were not listed in the Johnson & Ettinger chemical database, and subsequently they were not evaluated. They are 2-butanone, 2-hexanone, 4-methyl-2-pentanone, chloroethane, chloromethane, and trans-1,3-dichloropropene. If these compounds must be evaluated, I will have to use a different model for these compounds that is considered to be less accurate than J&E.

Xylene is listed as o-xylene, m,p-xylene, and total xylene in the soil concentration data. Since xylene is listed in the chemical database as o-xylene, m-xylene, and p-xylene, m,p-xylene was treated as though the combined concentration of m,p-xylene exists as either all m-xylene or all p-xylene.

Xylene is also listed as total xylenes in the groundwater concentration data. Again the xylenes were treated as though the combined concentration of the xylenes exist as either all o-xylene, m-xylene, or p-xylene.

For the groundwater concentration data, 1,2-dichloroethene (total) was treated as though the chemical exists as either all cis-1,2-dichloroethene or trans-1,2-dichloroethene.



The groundwater data used to generate the indoor air concentrations were from the table *Maryland Sand, Gravel and Stone Site, Last Four Quarters' Shallow Ground Water Monitoring Data*. Each round of groundwater data (8/01, 5/01, 2/01, 11/00) were evaluated separately.

The soil concentration data was provided by Environ in a table entitled, *Exposure Point Concentration (ug/kg) in Soil Outside Ground Water Principal Threat Area (95% UCL or Maximum, whichever is lower)*. The areas of the site that were evaluated were the Buried Waste Area (BWA), the Northern Depression Area (NDA), Pond 1, Pond 2, Pond 3, the Soil Piles, and the Soil Staging Area.

Most of the parameters used in the Johnson and Ettinger models were defaults. The parameters are listed below:

Site Characteristics Used in the Analysis		
Model Parameter	Value	
Depth below grade to bottom of enclosed floor space	200 cm	(default depth for basements)
Depth below grade to water table	400 cm	(default)
SCS soil type directly above water table	sandy loam	
Average soil/groundwater temperature	10 degrees C	(default)
Vadose zone SCS soil type groundwater	loam	
soil: BWA	sandy loam	
NDA	loam	
Pond 1	loam	
Pond 2	loam	
Pond 3	loam	
Soil Piles	sandy loam	
Soil Staging Area	sandy loam	
Vadose zone soil dry bulk density	1.5 g/cm ³	(default)
Vadose zone soil total porosity	0.43	(default)
Vadose zone soil water-filled porosity	0.3	(default)
Vadose zone soil organic carbon fraction	0.002	(default)

The attached tables contain the results of the analysis.

If you have any questions or concerns, please contact me at x2193.

cc: D. Ioven (3HS41)

Maryland Sand Gravel & Stone Revised Calculations
Groundwater - Indoor Air Modeling Using the Johnson & Ettinger GW Screening Model

Parameters

Depth below grade to bottom of enclosed floor space - 2 meters default
 Depth below grade to water table - 4 meters default
 SCS soil type directly above water table - sandy loam default
 Average soil/groundwater temperature - 10 degrees C default
 Vadose zone SCS soil type (used to estimate soil vapor permeability) - loam default
 Vadose zone soil dry bulk density (g/cm3) - 1.5 default
 Vadose zone soil total porosity (unitless) - 0.43 default
 Vadose zone water-filled porosity (cm3/cm3) - 0.3 default

Contaminant	GW Conc. 8/01 ug/L	Indoor Air Conc. ug/m3	Risk Cancer	HI	GW Conc. 5/01 ug/L	Indoor Air Conc. ug/m3	Risk Cancer	HI	GW Conc. 2/01 ug/L	Indoor Air Conc. ug/m3	Risk Cancer	HI	GW Conc. 11/00 ug/L	Indoor Air Conc. ug/m3	Risk Cancer	HI
1,1-dichloroethane	310	3.52E-001	NA	6.8E-004	800	9.08E-001	NA	1.7E-003	120	1.36E-001	NA	2.6E-004	410	4.66E-001	NA	8.9E-004
1,1-dichloroethane	8.4	4.99E-002	1.0E-006	NA	3.6	2.14E-002	4.4E-007	NA	42	2.50E-001	5.1E-006	NA	73	4.34E-001	8.9E-006	NA
4-methyl-2-pentanone	3000				410				5200				9200			
benzene	1300	1.41E+000	4.5E-006	NA	1100	1.19E+000	3.8E-006	NA	1300	1.41E+000	4.5E-006	NA	1500	1.63E+000	5.2E-006	NA
chlorobenzene	19000	1.16E+001	NA	5.5E-001	15000	9.12E+000	NA	4.4E-001	28000	1.70E+001	NA	8.2E-001	28000	1.70E+001	NA	8.2E-001
chloroethane	1300				1100				2500				2800			
ethylbenzene	670	8.39E-001	NA	8.0E-004	620	7.77E-001	NA	7.4E-004	880	1.10E+000	NA	1.1E-003	840	1.05E+000	NA	1.0E-003
toluene	16000	1.88E+001	NA	4.5E-002	1300	1.53E+000	NA	3.7E-003	22000	2.59E+001	NA	6.2E-002	25000	2.94E+001	NA	7.0E-002
vinyl chloride	400	2.85E+000	5.2E-006	2.7E-002	450	3.21E+000	5.8E-006	3.1E-002	110	7.84E-001	1.4E-006	7.5E-003	1400	9.97E+000	1.8E-005	9.6E-002
xylenes (total)	3500				3100				4700				4900			
cis 1,2-dichloroethane	290	2.33E-001	NA	6.4E-003	500	4.02E-001	NA	1.1E-002	1000	8.04E-001	NA	2.2E-002	NA	3.70E+000	NA	3.5E-003
1,1,1-trichloroethane	340	1.14E+000	NA	1.1E-003	250	8.41E-001	NA	8.1E-004	540	1.82E+000	NA	1.7E-003	1100	9.20E-001	2.2E-007	NA
tetrachloroethane	22	6.74E-002	1.6E-008	NA	2.8	8.58E-003	2.0E-009	NA	130	3.98E-001	9.5E-008	NA	300	1.67E+000	1.2E-006	NA
trichloroethene	39	7.42E-002	5.2E-008	NA	3.6	6.85E-003	4.8E-009	NA	350	6.66E-001	4.7E-007	NA	880	1.67E+000	1.2E-006	NA
2-butanone	ND				ND				900				3000			
methylene chloride	ND				ND				270	1.29E-001	2.5E-008	4.1E-005	440	2.11E-001	4.1E-008	6.7E-005
1,2-dichloroethane	ND				ND				ND				26	4.91E-003	5.2E-008	NA
1,2-dichloroethene (total)	NA				NA				NA				1500			
o-xylene	3500	2.89E+000	NA	4.0E-004	3100	2.56E+000	NA	3.5E-004	4700	3.88E+000	NA	5.3E-004	4900	4.05E+000	NA	5.5E-004
m-xylene	3500	4.01E+000	NA	5.5E-004	3100	3.55E+000	NA	4.9E-004	4700	5.38E+000	NA	7.4E-004	4900	5.61E+000	NA	7.7E-004
p-xylene	3500	4.01E+000	NA	5.5E-004	3100	3.55E+000	NA	4.9E-004	4700	5.38E+000	NA	7.4E-004	4900	5.61E+000	NA	7.7E-004
cis 1,2-dichloroethene	NA				NA				NA				1500	1.21E+000	NA	3.3E-002
trans 1,2-dichloroethene	NA				NA				NA				1500	2.91E+000	NA	4.0E-002

MSC&S Revised Calculations

Maryland Sand Gravel & Stone
 Soil - Indoor Air Modeling Using the Johnson & Ettinger Soil Screening Model

Parameters

Depth below grade to bottom of enclosed floor space - 2 meters default
 Depth below grade to top of contamination - 4 meters default
 Average soil/groundwater temperature - 10 degrees C default
 Vadose zone SCS soil type (used to estimate soil vapor permeability) - BWA - sandy loam, NDA, Pond1 & 2 & 3 - loam, Soil Piles & Soil Stegling Area - sandy loam.
 Vadose zone soil dry bulk density (g/cm3) - 1.5 default
 Vadose zone soil total porosity (unitless) - 0.43 default
 Vadose zone water-filled porosity (cm3/cm3) - 0.3 default
 Vadose zone soil organic carbon fraction (unitless) - .002 default

Risk Parameters

Averaging time for carcinogens = 70 years. Exposure duration = 30 years.
 Averaging time for noncarcinogens = 30 years. Exposure frequency = 350 days/yr

Chemical	BWA	Soil Conc. ug/kg	Indoor Air Conc. ug/m3	Risk Cancer	HI	Soil Conc. ug/kg	Indoor Air Conc. ug/m3	Risk Cancer	HI	Soil Conc. ug/kg	Indoor Air Conc. ug/m3	Risk Cancer	HI
1,1,1-TRICHLOROETHANE	2,200	4.03E+001	NA	NA	3.9E-002	36	2.71E-001	NA	2.6E-004	859	6.47E+000	NA	6.2E-003
1,1,2-TRICHLOROETHANE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2-TRICHLOROETHANE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1-DICHLOROETHANE	NA	NA	NA	NA	NA	NA	NA	NA	NA	230	9.64E-001	NA	1.8E-003
1,1-DICHLOROETHANE	65	2.61E+000	5.4E-005	NA	NA	180	2.90E+000	6.0E-005	NA	300	2.41E-001	2.6E-006	NA
1,2-DICHLOROETHANE	170	3.53E-001	3.8E-006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-DICHLOROETHANE (TOTAL)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-DICHLOROPROPANE	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,061	NA	NA	NA
2-BUTANONE	5,400	NA	NA	NA	NA	NA	NA	NA	NA	16	NA	NA	NA
2-HEXANONE	32	NA	NA	NA	NA	NA	NA	NA	NA	110	NA	NA	NA
4-METHYL-2-PENTANONE	4,900	NA	NA	NA	NA	NA	NA	NA	NA	16	6.99E-004	NA	1.9E-006
ACETONE	910	1.15E-001	NA	NA	3.1E-004	NA	3.34E-003	1.1E-008	NA	190	6.35E-001	2.0E-006	NA
BENZENE	240	1.99E+000	6.4E-006	NA	NA	1	NA	NA	NA	NA	NA	NA	NA
BROMODICHLOROMETHANE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BROMOFORM	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BROMOMETHANE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CARBON DISULFIDE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CARBON TETRACHLORIDE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CHLOROBENZENE	4,100	9.44E+000	NA	NA	4.5E-001	NA	1,290	NA	NA	1,290	1.23E+000	NA	5.9E-002
CHLOROETHANE	NA	NA	NA	NA	NA	NA	78	NA	NA	NA	NA	NA	NA
CHLOROFORM	26	1.79E-001	1.7E-006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CHLOROMETHANE	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,048	3.06E+000	NA	8.4E-002
CIS-1,2-DICHLOROETHENE	11	7.75E-002	NA	NA	2.1E-003	NA	NA	NA	NA	NA	NA	NA	NA
CIS-1,3-DICHLOROPROPENE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
DIBROMOCHLOROMETHANE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ETHYLBENZENE	490	1.60E+000	NA	NA	1.5E-003	NA	47	NA	NA	140	1.89E-001	NA	1.8E-004
M,P-XYLENE	1,400	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
METHYLENE CHLORIDE	220	1.19E+000	2.3E-007	NA	3.8E-004	NA	280	5.95E-001	1.1E-007	300	2.68E-001	NA	3.7E-005
O-XYLENE	910	2.02E+000	NA	NA	2.8E-004	NA	NA	NA	NA	NA	NA	NA	NA
STYRENE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TETRACHLOROETHENE	9,100	1.25E+002	3.0E-005	NA	NA	12	2.48E-002	NA	5.9E-005	1,887	3.90E+000	NA	9.4E-003
TOLUENE	2,200	1.13E+001	NA	NA	2.7E-002	NA	2	1.21E-002	NA	2	1.21E-002	NA	1.7E-004
TRANS-1,2-DICHLOROETHENE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TRANS-1,3-DICHLOROPROPENE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TRICHLOROETHENE	4,000	3.41E+001	2.4E-005	NA	NA	5	1.75E-002	1.2E-008	NA	33	1.15E-001	8.1E-008	NA
VINYL CHLORIDE	NA	NA	NA	NA	NA	NA	NA	NA	NA	160	3.81E+000	6.9E-006	3.7E-002
XYLENE (TOTAL)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M-XYLENE	1,400	3.78E+000	NA	NA	5.2E-004	NA	NA	NA	NA	47	5.32E-002	NA	7.3E-006
P-XYLENE	1,400	3.98E+000	NA	NA	5.5E-004	NA	NA	NA	NA	47	5.50E-002	NA	7.5E-006

NA - Not applicable

MSG&S Revised Calculations

Maryland Sand Gravel & Stone
Soil - Indoor Air Modeling Using the Johnson & Ettinger Soil Screening Model

Parameters

Depth below grade to bottom of enclosed floor space - 2 meters default
 Depth below grade to top of contamination - 4 meters default
 Average soil/groundwater temperature - 10 degrees C default
 Vadose zone SCS soil type (used to estimate soil vapor permeability) - BWA - sandy loam, NDA, Pond1 & 2 & 3 - loam, Soil Piles & Soil Staging Area - sandy loam.
 Vadose zone soil dry bulk density (g/cm3) - 1.5 default
 Vadose zone soil total porosity (unitless) - 0.43 default
 Vadose zone water-filled porosity (cm3/cm3) - 0.3 default
 Vadose zone soil organic carbon fraction (unitless) - .002 default

Risk Parameters

Averaging time for carcinogens = 70 years. Exposure duration = 30 years.
 Averaging time for noncarcinogens = 30 years. Exposure frequency = 350 days/yr

Chemical	Pond 2			Pond 3			Soil Piles			Soil Staging Area		
	Soil Conc. ug/kg	Indoor Air Conc. ug/m3	Risk Cancer	HI	Soil Conc. ug/kg	Indoor Air Conc. ug/m3	Risk Cancer	HI	Soil Conc. ug/kg	Indoor Air Conc. ug/m3	Risk Cancer	HI
1,1,1-TRICHLOROETHANE	2,746	2,07E+001	NA	2,0E+002	339	2,55E+000	NA	2,4E+003	470	8,61E+000	NA	8,3E+003
1,1,2,2-TETRACHLOROETHANE	51	7,22E+003	1,7E+007	NA	13	1,84E+003	4,4E+008	NA	NA	8,61E+000	NA	8,3E+003
1,1,2-TRICHLOROETHANE	NA	NA	NA	NA	19	9,90E+003	6,5E+008	NA	NA	8,61E+000	NA	8,3E+003
1,1-DICHLOROETHANE	58	2,43E+001	NA	4,7E+004	90	3,77E+001	NA	7,2E+004	240	2,43E+000	NA	4,7E+003
1,1-DICHLOROETHENE	1,246	2,01E+001	4,1E+004	NA	40	6,44E+001	1,3E+005	NA	14	5,62E+001	1,2E+005	NA
1,2-DICHLOROETHANE	8	6,44E+003	6,9E+008	NA	2	1,81E+003	1,7E+008	NA	NA	4,57E+002	4,9E+007	NA
1,2-DICHLOROETHENE (TOTAL)	NA	NA	NA	NA	NA	1,78E+003	NA	4,3E+004	NA	NA	NA	NA
1,2-DICHLOROPROPANE	NA	NA	NA	NA	1	1,78E+003	NA	4,3E+004	NA	NA	NA	NA
2-BUTANONE	310	NA	NA	NA	1,800	20,000	NA	NA	250	NA	NA	NA
2-HEXANONE	3	NA	NA	NA	16	3,300	NA	NA	830	NA	NA	NA
4-METHYL-2-PENTANONE	2,230	NA	NA	NA	1,812	4,500	NA	NA	NA	NA	NA	NA
ACETONE	130	5,68E+003	NA	1,6E+005	447	1,95E+002	NA	5,3E+005	NA	3,74E+001	1,2E+006	NA
BENZENE	2,232	7,45E+000	2,4E+005	NA	102	3,41E+001	1,1E+006	NA	45	3,74E+001	1,2E+006	NA
BROMODICHLOROMETHANE	NA	NA	NA	NA	NA	NA	NA	NA	860	3,19E+001	1,4E+007	NA
BROMOFORM	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BROMOMETHANE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CARBON DISULFIDE	1	1,95E+002	NA	2,7E+005	3	5,84E+002	NA	8,0E+005	NA	NA	NA	NA
CARBON TETRACHLORIDE	6	6,01E+002	3,7E+007	NA	7	7,01E+002	4,3E+007	NA	NA	NA	NA	NA
CHLOROBENZENE	15,133	1,45E+001	NA	6,9E+001	376	3,59E+001	NA	1,7E+002	14,000	3,22E+001	NA	1,5E+000
CHLOROETHANE	140	NA	NA	NA	35	NA	NA	NA	130	NA	NA	NA
CHLOROFORM	NA	NA	NA	NA	59	1,59E+001	1,5E+006	NA	36	2,49E+001	2,3E+006	NA
CHLOROMETHANE	1	1,69E+001	NA	4,6E+003	3	1,69E+001	NA	4,6E+003	8,900	6,27E+001	NA	1,7E+000
CIS-1,2-DICHLOROETHENE	57	1,69E+001	NA	4,6E+003	58	1,69E+001	NA	4,6E+003	NA	NA	NA	NA
CIS-1,3-DICHLOROPROPENE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
DIBROMOCHLOROMETHANE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ETHYLBENZENE	110	1,49E+001	NA	1,4E+004	105	1,42E+001	NA	1,4E+004	820	2,68E+000	NA	2,6E+003
M,P-XYLENE	4,109	NA	NA	NA	34	1,500	NA	NA	130	5,88E+001	NA	5,6E+004
METHYLENE CHLORIDE	NA	NA	NA	NA	NA	55	NA	NA	55	2,98E+001	5,8E+008	NA
O-XYLENE	1,981	1,77E+000	NA	2,4E+004	107	9,56E+002	NA	1,3E+005	1,300	2,89E+000	NA	9,5E+005
STYRENE	1	2,45E+004	NA	2,4E+007	NA	340	2,00E+001	NA	340	2,00E+001	NA	1,9E+004
TETRACHLOROETHENE	390	2,24E+000	5,4E+007	NA	85	4,89E+001	1,2E+007	NA	1,400	1,93E+001	4,6E+006	NA
TOLUENE	1,816	3,75E+000	NA	9,0E+003	409	8,46E+001	NA	2,0E+003	6,500	3,34E+001	NA	8,0E+002
TRANS-1,2-DICHLOROETHENE	NA	NA	NA	NA	19	1,15E+001	NA	1,8E+003	NA	NA	NA	NA
TRANS-1,3-DICHLOROPROPENE	110	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TRICHLOROETHENE	1,309	4,58E+000	3,2E+006	NA	235	8,22E+001	5,7E+007	NA	1,000	8,53E+000	6,0E+006	NA
VINYL CHLORIDE	49	1,17E+000	2,1E+006	1,1E+002	45	1,07E+000	1,9E+006	1,0E+002	430	2,62E+001	4,7E+005	2,5E+001
XYLENE (TOTAL)	11	NA	NA	NA	250	NA	NA	NA	NA	NA	NA	NA
M-XYLENE	4,109	4,65E+000	NA	6,4E+004	34	3,85E+002	NA	5,3E+006	1,500	4,05E+000	NA	5,5E+004
P-XYLENE	4,109	4,81E+000	NA	6,6E+004	34	3,98E+002	NA	5,5E+006	1,500	4,28E+000	NA	5,8E+004

NA - Not applicable